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AUTHOR Gottfredson, Gary D.
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ABSTRACT

The Randomized Response Technique (RRT) appears to have promise in future work which studies the relation of school variables to disruption or delinquent behavior. The RRT is especially useful in situations when it is difficult or undesirable directly to ask stigmatizing questions. The proportions of students in this study estimated to have used morphine, marijuana or cigarettes were generally higher when self-report techniques were used. Use of RRT achieves confidentiality by introducing random error into individuals' responses, and consequently offers more potential for estimating proportions, testing for differences between proportions, and doing time series studies of delinquency. (BN)

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Using the Randomized Response Technique to Estimate the
Extent of Delinquent Behavior in Schools

Gary D. Gottfredson
Johns Hopkins University

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Using the Randomized Response Technique to Estimate
the Extent of Delinquent Behavior in Schools

The use of a technique originally suggested by Warner (Journal of American Statistical Association, 1965, 60, 63-69) for allowing a respondent to maintain privacy through the device of randomizing his or her response was explored using a sample of 644 secondary school students. Results using the randomized response technique (RRT) were compared with results obtained using ordinary self-report (SR). The proportions of students estimated to have used morphine, marijuana, or cigarettes were generally higher when estimates were derived from RRT rather than SR. Use of RRT achieves confidentiality by introducing random error into individuals' responses, and consequently offers most promise for estimating proportions, testing for differences between proportions, or for ecological or aggregate level correlational or time series studies of delinquency or other topics where it may be important to avoid stigmatizing the subjects of research by requiring them to respond to sensitive questions.

Using the Randomized Response Technique to Estimate the Extent of Delinquent Behavior in Schools

Our knowledge of offensive behavior in schools has increased greatly in the last year with the publication of the report of the Safe School Study (National Institute of Education, 1977) and reports from urban victimization surveys (McDermott & Hindelang, 1977). We now have much better information on the frequency with which schools, teachers, and students become the victims of offensive behavior. One issue hardly addressed at all in those studies, however, is how many students engage in violent or disruptive behavior. The available information is based mainly on reports from students, teachers, principals, or the public about the numbers of incidents of victimization of various sorts. Very few attempts have been made to ask students if they themselves had engaged in offensive behavior. This distinction appears important. Self-report data on trends in the numbers of youth engaging in delinquent behavior in schools between 1967 and 1972 (Gold & Moles, 1977) may not accord in all details with trends in reported victimizations. The Gold and Moles self-report data on students committing assaults, threats, thefts, and vandalism shows a decline between 1967 and 1972. In contrast, the Safe School Study report summarizes several sources of victimization reports that imply some increase for some of these categories of offensive behavior. These results could be consistent with each other. The rate of incidents could increase while the rate of offenders decreases if each offender commits more offenses.

Evidence about the numbers of students engaging in delinquent or disruptive behavior may have useful implications for selecting strategies for dealing with problems in schools. As McPartland and McDill (1977) note, strategies for dealing with school disruption may be quite different when large proportions of the studentry are involved in perpetrating disorder than when only small proportions are so engaged. Those authors suggest that whereas crisis interventions or isolation strategies may be appropriate when few students are disruptive, more general reforms would be needed in schools where many students are involved in disruptive behavior. In addition, dependable data about school delinquency will be required to evaluate administrative practices and to test theories of delinquency.

How may the numbers or proportions of students engaged in offensive behavior be estimated? Rates of delinquency estimated from official records are low because many offenses are undetected, unreported, or unrecorded, and may contain biases due to differential treatment of people from different social groups (Biderman & Reiss, 1967; Sellin & Wolfgang, 1964).

A widely shared perception that official data yield low estimates of crime has led to use and examination of self-reported victimization data (National Criminal Justice Information and Statistics Service, 1976; Panel for the Evaluation of Crime Surveys, 1976) and self-report data on offenses committed by individuals (Gold & Reimer, 1975; Petersilia, Greenwood & Lavin, 1977). Self-report measures have, of course, been subject to criticism, and other approaches including peer reports have been tried (Jessor, Graves, Hanson & Jessor, 1968). I do

not intend to go into any of these criticisms now. Instead, I shall describe the potential of one alternative technique and present some evidence that this technique may result in even higher estimates of the proportions of individuals engaging in delinquent behavior than do simple self-reports.

The use of anonymous self-reports of delinquent or disruptive behavior taps the best informed source of information about this behavior. Unfortunately, however, response bias is likely to be present due to fear of self-incrimination for offenses for which the respondent could conceivably be prosecuted, to avoid embarrassment, or due to any of a number of other pressures to appear in conformity with desirable rather than undesirable standards of behavior. In addition, the collection of this kind of information from school students poses special problems due to its highly sensitive nature and to a desire to provide every possible protection of the subjects of research from embarrassment or disclosure of responses.

For these reasons, my colleagues¹ and I experimented in a small way with an interesting alternative method of obtaining this kind of sensitive information. Warner (1965) has suggested a technique allowing the respondent to maintain privacy through the device of randomizing his or her response. The subject may be presented, for example, with two printed "yes-no" questions, one in red and one in black. One of these questions is stigmatizing and the other is

¹This experiment was conducted in collaboration with Cheah Oon Siew of the Penang General Hospital and Chee Kim Loy of the Universiti Sains Kebangsaan.

unrelated and not stigmatizing. By use of a randomizing device the respondent selects the question to be answered and does not reveal to the investigator which question has been chosen. Given responses for a large number of people and knowledge of the probability with which the sensitive question was chosen, simple algebraic techniques permit one to estimate the proportion engaging in the sensitive behavior. In the case where the population proportion answering "yes" to the unrelated question is known, the proportion of those answering "yes" to the critical question, assuming truthful response is as follows:

$$\pi_c | \pi_u = \frac{\lambda - \pi_u(1 - P)}{P} \quad (1)$$

with variance

$$\text{Var.} (\pi_c | \pi_u) = \frac{\lambda(1 - \lambda)}{nP^2} \quad (2)$$

where

λ = the probability that a "yes" answer will be made

P = the probability that the critical question will be selected

n = the number of respondents

π_c = the proportion of persons "yes" for the critical question

π_u = the proportion of persons "yes" for the unrelated question.

The estimates of $\pi_c | \pi_u$ are obtained by substituting the observed proportion of "yes" responses in the sample for λ (Greenberg, Abul-Ela, Simmons & Horvitz, 1969).

The Penang (West Malaysia) State Health Office and the State Education Office had become concerned about the extent of illicit use of psychoactive substances in the state's schools. I was asked to find ways to measure the extent to which secondary school students were using a variety of substances, including heroin, morphine (Penang youth would inject morphine subcutaneously), and ganja (a potent form of marijuana). Estimating the proportions of students who had used these substances seemed to present especially difficult problems because of the highly sensitive nature of the information sought. Because I was concerned about the sensitive and stigmatizing questions that would have to be asked, I looked for a technique that would increase the possibility of candid answers. The randomized-response technique (RRT) had already been used by demographers in several studies of illegally induced abortions in North Carolina and Taiwan (Abernathy, Greenberg & Horvitz, 1970; Greenberg, Kuebler, Abernathy & Horvitz, 1971; I-Cheng, Chow & Rider, 1972), and Warner's (1965) original theoretical work had already been extended in several ways (Abul-Ela, Greenberg & Horvitz, 1967; Gould, Shah & Abernathy, 1970; Greenberg, et al., 1969).² Candid responses and the assurance of privacy are promoted by ensuring that no one but the respondent knows what question is being answered in any instance. The investigator knows only what the answer was, what the alternative questions were, and the probability that the answer is an answer to the sensitive question of interest. Because of the apparent usefulness of this

²It has since been extended in other ways (Clickner & Iglewicz, 1976; Drane, 1976).

technique in studies of illegal abortions and with populations including individuals with less education than secondary school students, we decided to test this technique in gathering information about another illegal behavior--drug use--in secondary schools.

We selected 644 students from 19 Penang English-medium urban secondary schools (263 Form 4 pupils, 291 Form 5 pupils, and 90 Form 6 students; 328 boys and 316 girls). The sample was selected to assure diversity, not to provide a representative sample. It included schools in which knowledgeable persons suspected a substantial drug use problem and schools in which little problem was suspected.³

Two types of self-reports were solicited--ordinary self-report and self-report in which the sensitive question was selected with

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Malay and Chinese medium schools were not included in the sample. The sample of schools was selected as follows: names of all secondary English-medium schools were sorted by knowledgeable persons (who wish to remain anonymous) according to the extent of suspected drug usage. The top and bottom halves of the cards were shuffled separately and 10 cards chosen from each (one school could not participate due to its internal examination schedule). A total of 35 students were chosen from each school for group administration of the questions. Participants within schools were randomly selected as follows: If there were N classes (Form 4 to Form 6) in a school, then $35/N$ pupils (expressed to a whole number) in each class were selected by assigning each student a number and publicly drawing random numbers from a bowl. This somewhat elaborate and showy selection procedure was intended to avoid stigmatizing any individual pupil by choosing him or her for participation. As noted, we were more interested in obtaining a diverse sample than a representative one.

probability = .7 with respondents using specially prepared decks of playing cards to select the questions. Each sensitive question was paired with a nonsensitive question. For example, "Have you ever smoked ganja?" was paired with "Were you born in the month of April?" (Data about the month of birth of these populations were available from other sources.) Table 1 shows some results comparing estimates derived from ordinary self-reports with those obtained using the RRT. Because virtually no one reported using heroin those results are not shown. Results for use of morphine, ganja, and cigarettes are shown. The estimates produced using RRT are usually higher than those made using ordinary self-report.

An additional result is interesting as well. At the end of the ordinary self-report section respondents were asked whether or not their friends would respond truthfully to a question about use of ganja on a questionnaire like the one used. A total of 17% said "yes," 49% "no," and 34% were undecided. After the RRT section respondents were asked whether they thought their friends would respond truthfully about ganja smoking in a similar "card game." A total of 31% said "yes," 34% "no," and 35% were undecided. In other words, substantially more students thought that RRT would promote veridical reporting.

Now, RRT does have some substantial drawbacks. Chief among these is that it introduces random error into individuals' responses. This would make the technique almost useless in the individual-level study of delinquency or disruption in schools. The use of multiple trials per respondent can reduce this measurement error somewhat

(Gould, 1970; Liu & Chow, 1972), but RRT clearly shows most promise for estimating proportions, testing differences between proportions (Levy, 1976, 1977), and for ecological or aggregate level correlational or time series analyses (Gottfredson, 1978). Many of the questions addressed in the Safe School Study were questions of this type. In summary, RRT appears to have promise in future work in studying the relation of school variables to disruptive or delinquent behavior when it may be difficult or undesirable to directly ask stigmatizing questions of students.

- Abernathy, J. R., Greenberg, B. G., & Horvitz, D. G. Estimates of induced abortion in urban North Carolina. Demography, 1970, 1, 19-29.
- Abul-Ela, A.-L. A., Greenberg, B. G., & Horvitz, D. G. A multi-proportions randomized response model. Journal of the American Statistical Association, 1967, 62, 990-1008.
- Biderman, A. D., & Reiss, A. J., Jr. On exploring the dark figure of crime. Annals of the American Academy of Political and Social Science, 1967, 374, 1-15.
- Clickner, R. P., & Iglewicz, B. Warner's randomized response technique: The two sensitive question case. Proceedings of the Social Statistics Section, 1976, pt. 1, 260-263.
- Drane, W. On the theory of randomized responses to two sensitive questions. Proceedings of the Social Statistics Section, 1976, pt. 1, 282-285.
- Gold, M., & Reimer, D. J. Changing patterns of delinquent behavior among Americans 13 through 16 years old: 1967-72. Crime and Delinquency Literature, 1975, 7, 483-517.
- Gould, A. L., Shah, B. V., & Abernathy, J. R. Unrelated question randomized response techniques with two trials per respondent. Proceedings of the Social Statistics Section, ca 1970, 351-358.
- Gottfredson, G. D. Models and muddles in human ecology: An examination of high school crime rates (Research report No. 255). Johns Hopkins University, Center for Social Organization of Schools, 1978.

- Greenberg, B. G., Kuebler, R. R., Abernathy, J. R., & Horvitz, D. G. Application of the randomized response technique in obtaining quantitative data. Journal of the American Statistical Association, 1971, 66, 243-250.
- I-Cheng, C., Chow, L. P., & Rider, R. V. The randomized response technique as used in the Taiwan outcome of pregnancy study. Studies in Family Planning, 1972, 3, 265-269.
- Jessor, R., Graves, T. D., Hanson, R. C., & Jessor, S. L. Society, personality and deviant behavior. New York: Holt, Rinehart and Winston, 1968.
- Levy, K. J. Reducing the occurrence of omitted or untruthful responses when testing hypotheses concerning proportions. Psychological Bulletin, 1976, 83, 759-651.
- Levy, K. J. The randomized response technique and large sample comparisons among the parameters of k independent binomial populations. Psychological Bulletin, 1977, 84, 244-246.
- Liu, P. T., & Chow, L. P. The efficiency of the multiple trial randomized response technique. Biometrics, 1976, 32, 607-618.
- McDermott, M. J. & Hindelang, M. J. Criminal victimization in urban schools (Analytical report 5D-VAD-15). Albany, NY: Criminal Justice Research Center, 1977.
- McPartland, J. M., & McDill, E. L. Parallels and contrasts in reform strategies for school violence. In J. M. McPartland and E. L. McDill (eds.), Violence in schools: Perspectives, programs, and positions. Lexington, Mass.: Lexington, 1977.
- National Criminal Justice Information and Statistics Service. Criminal victimization in the United States (Report no. SD-NCP-N-4). Washington, D.C.: U.S. Government Printing Office, 1976.
- National Institute of Education. Violent schools--safe schools: The safe school study report to Congress, Volume 1. Washington, D.C.: Author, 1977.
- Panel for the Evaluation of Crime Surveys, Committee on National Statistics, Assembly of Mathematical and Physical Sciences, National Research Council. Surveying crime. Washington, D.C.: National Academy of Sciences, 1976.
- Petersilia, J., Greenwood, P. W., & Lavin, M. Criminal Careers of habitual felons (R-2144-DOJ). Santa Monica, Calif.: Rand, 1977.

Sellin, T., & Wolfgang, M. E. The measurement of delinquency. New York: Wiley, 1964.

Warner, S. L. Randomized response: A survey technique for eliminating evasive answer bias. Journal of the American Statistical Association, 1965, 60, 63-69.

Table 1

A Comparison of Percentages of Undesirable Behavior Estimated by Simple-Self Report and by the Randomized Response Technique

Behavior	Boys (n = 328)		Girls (n = 316)		Total (n = 644)	
	S-R	RRT	S-R	RRT	S-R	RRT
Used morphine	2.1 (0.8)	2.1 (1.1)	0.0 (-)	2.8 (1.3)	1.1 (0.4)	2.4 (0.9)
Smoked ganja	5.2 (1.2)	8.2 (2.2)	0.0 (-)	0.0 (-)	2.6 (0.6)	4.2 (1.1)
Smoked cigarettes	44.5 (2.7)	57.6 (3.9)	13.3 (1.9)	22.6 (3.4)	30.6 (1.8)	40.3 (2.8)

Note.- Standard errors are shown in parentheses.